

**COMBATANT LOGISTICS COMMAND AND CONTROL  
FOR THE  
JOINT FORCES COMMANDER**



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## COMBATANT LOGISTICS COMMAND AND CONTROL FOR THE JOINT FORCES COMMANDER

*Logistics Awareness is Necessary for Dominant Awareness and Focused Logistics*

### **EXECUTIVE SUMMARY**

Joint doctrine says that "to exercise control at the strategic, operational and tactical levels of war, commanders must also exercise control over logistics." Control cannot be exercised without timely and comprehensive information, a picture of the battlefield logically speaking, including not only what is already on the battlefield but what is flowing into it as well. Much of the information required is available, but in disparate systems. This is because the doctrine that says that there should be a single logistics authority in joint operations also says that each Service is responsible for sustaining its own forces. Thus Combatant Logistics Command and Control (CLCC) is about the need for a single system which would provide seamless visibility of deployment surge and sustainment logistics, comprehensive of all Service components, mobility commands and defense logistics agencies. This report is an analysis of the requirement for and some of the characteristics of such a system.

Logistics in the 1990-91 Gulf War is closely examined to better define the Joint Forces Commander's need for logistics information. Clearly logistics was one of the successes of the Gulf War, but there were problems as well. What the Joint Forces Commander, General Schwartzkopf, had available in terms of logistics information is explored. That there were any shortcomings in his logistics information was irrelevant given the amount of Cold War resources available, the nature and extent of host nation support, and that Iraq relinquished the initiative thus affording the Coalition ample time to prepare for war. However, had Iraqi forces surged into Saudi Arabia in September or October 1990, General Schwartzkopf's response would very much have depended on timely and comprehensive logistics information. Further, there is no reason to believe that resources abundance, fantastic host nation support, and adequate preparation time will characterize any future conflict.

While logistics receives a lot of attention during a conflict, it is generally ignored once a conflict has ended. This has not been the situation, however, since the end of the Gulf War for a number of reasons. First there were legitimate, serious problems that were revealed in the Gulf War which needed attention. A second reason relates to the Revolution in Military Affairs and its implications for logistics. In the context of the Revolution in Military Affairs, Combatant Logistics Command and Control can be seen as providing *logistical awareness*. Yet another reason is the pressure on the defense budget and the ensuing demand to perform all functions, including logistics, less expensively and more effectively. However, with some

exceptions, logistics information systems have not received attention. There has been no call for logistics to share in the increasing amount of communications bandwidth available because operational logistics support software largely does not exist.

The theme of this report is that logistics is a central part of the operational and tactical levels of warfare and needs to be included in the command and control system of the joint forces commander. Logistics has generally not been afforded this recognition. It has been seen as an administrative aspect of military operations rather than an operational and tactical component of combat. Running out of fuel or ordnance while in combat is painfully operational.

The commander's requirement is for information and not just data. Data becomes information with which to create a picture of the logistics of the forces on the battlefield, to predict the sustainability of those forces, and to evaluate alternative courses of action as they are affected by logistics when it has been processed by software built around models that transform input data (tons of ordnance or barrels of fuel for example) into measures of sustainability (days of supply for example). Further there is the requirement that such information be generated not for just the current moment in time but for the future as well. This implies the need for models that can predict sustainability some distance into the future. Better logistics planning factors incorporated in models of the use and replenishment of commodities, much better visibility of the stocks of material on the battlefield and flowing into it, and the ability to predict sustainability will enable appropriate levels of sustainability to be achieved with minimal stocks of sustainment materials.

Lacking such capabilities, General Schwarzkopf sought to assure himself of appropriate levels of sustainability by demanding that there be 60 days of supply of all sustainment materials in theater. This was a brute force approach necessitated by the absence of sustainment planning models. Huge stockpiles that took months to accumulate and represented a huge footprint and vulnerability can be avoided and logistics more focused if the capabilities of the combatant logistics command and control system described herein are developed.

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## 1. INTRODUCTION

*“Every unit that is not supported is a defeated unit.”*

Maurice de Saxe, 1732

The decade of the 1970s saw the end of the Vietnam conflict, the end of the draft, the establishment of the All Volunteer Force, and the beginnings of R&D programs in smart weapons, stealth technology, communications, and command and control systems. Logistics, however, was not included in these R&D programs. The programs begun in the 1970s would have a spectacular impact on events in 1991.

At the operational and tactical levels of war, the Gulf War of 1990-91 was a huge success. It was the first opportunity to implement the Joint Forces Commander (JFC) organization since the passage of the Goldwater-Nichols Act of 1986. It was both Joint and Combined with the forces of the Coalition. It was a resounding success for the All Volunteer Force established in 1973. It was a tour de force for the stealth and smart weapons programs begun in the 1970s. The war opened with a six week air campaign brilliantly executed through the Air Tasking Order issued by the Joint Force Air Component Commander. The ground war took less than four days to achieve its objectives and resulted in fewer American casualties than result from an average weekend's driving on the nation's highways. It was a success for logistics too, in the sense that all the requirements for a conventional war in Southwest Asia were met.

The success of smart weapons and technology in general prompted speculation that existing and foreseeable new capabilities would enable new paradigms of warfare and that the United States was postured for a potential Revolution in Military Affairs (RMA). A leading spokesman for RMA was Admiral William Owens from his position as Vice Chairman of the Joint Chiefs of Staff. The revolution, Admiral Owens argued, will be based on information technology which will allow the use of military force more promptly, with greater precision, with less risk, and with more effectiveness. The core technology areas postulated by Admiral Owens were (1) intelligence, surveillance, and reconnaissance, (2) command, control, communications, computers and intelligence (C4I), and (3) precision guided munitions. The revolutionary capabilities would then be Battlespace Awareness, Advanced C4I, and Precision Force Use.

Admiral Owens forecasted that, in the not too distant future, information technology, precision guided munitions, and a system of systems, Ref (1), will enable smaller, different, and more effective forces. He asked why electronic warfare jammer aircraft would be needed if we could destroy every hostile radar emitter minutes or seconds after it is activated, and whether there would still be a need for close-air support if we knew where an opponent's ground forces were and could attack them with long-range weapons. He didn't actually suggest that ground forces would be unnecessary in future conflicts, but he certainly forecasted far fewer troops on the ground than were employed in the Gulf War. With fewer ground forces to support and the use of precision guided munitions instead of thousands of tons

of dumb bombs, strategic lift of forces, equipment, and sustainment material requirements would be greatly reduced. With reduced requirements and the capability to track logistics from supply point to user that is anticipated, Admiral Owens asked why we should retain all the logistics-handling units we have today.

The Gulf War essentially coincided with the successful conclusion of the Cold War. Throughout history, successful wars have been followed by disestablishment of a significant portion of the military structure which led to the success. With concern for the size and growth of the Federal budget deficit and the lack of an identifiable threat, the Department of Defense budget has been reduced and the Services have had to make major adjustments in force structure. Thus the Services are seeking new ways of doing business based both on the potential of RMA and out of economic necessity. Change is the watchword. Technology in the form of new capabilities must be incorporated into new doctrine, operations, and tactics and these matters are also receiving a lot of attention. This report urges that logistics receive attention as well and seeks to indicate what sorts of attention is needed.

The second section of this report examines the attention paid to logistics in the period from the Korean conflict to the Gulf War and concludes that benign neglect is an appropriate characterization. The third section reviews some of the history of the Gulf War. Logistics operations in the Gulf War will be used to point out the need for CLCC. Section four analyzes the logistics experiences of each of the Services in the Gulf War. There were a number of problems that were experienced by all of the Services. Logistics initiatives undertaken since the Gulf War are discussed in section five. For the most part, these initiatives have addressed specific problems experienced in the Gulf War rather than CLCC. CLCC requirements are presented in section six and the report ends with its conclusion and recommendations in section seven.

## 2. LOGISTICS: 1970s TO THE GULF WAR

*"Strategy and tactics provide the scheme for the conduct of military operations, logistics the means therefore."*

Lieutenant Colonel George C. Thorpe, USMC, 1917

While logistics is the subject of much attention during times of actual conflict, it is not an inherently glamorous subject, is not close to the hearts of true warriors, and usually receives relatively little attention during interwar periods. An example was the experience of the 173rd Airborne Brigade during the first months of U.S. involvement in Vietnam. Ammunition had been supplied in "push" packages. Unfortunately, these packages had been developed and tailored based on Second World War and Korean War experience. When the 173rd arrived to protect the Ton Son Nhut airport near Saigon, they found that they were using ammunition faster than the rates for which the packages were designed. To make matters worse, some of the ammunition supplied was for weapon systems that had been retired from Army inventory. Over 255 tons of ammunition had to be flown from Okinawa in an

emergency effort to ensure Ton Son Nhut's security. The operation took every transport aircraft available in the theater for a period of seven days, Ref (2).

New logistics planning factors were created during the Vietnam conflict at the behest of Commander, Military Assistance Command Vietnam (MACV). Due to the coarseness of available data, the planning factors were derived by dividing the tons of stuff shipped into theater by the theater troop strength. Thus all the new planning factors were in units of pounds per man per day. Rations and M16 rounds are perhaps sensibly quoted in these terms but other commodities are not. Navy ship propulsion fuel usage was also (and until 1989) quoted in pounds per man per day in the JCS logistics planning factors! Navy logistics planners began the Gulf War in 1990 planning to have to supply each aircraft carrier with 180 tons of ammunition per day based on the Vietnam logistics planning factors. In Vietnam, carrier aircraft dropped a lot of dumb bombs. By early 1991 when the air campaign began in the Gulf War, precision guided munitions were available to partially substitute for the brute force tons of dumb bombs, and actual carrier ammunition usage was less than half of the planning factor.

While new high tech projects were being initiated in the 1970s, logistics was pretty much ignored. Non-high tech improvements to strategic sealift were bought in the early 1980s in the form of the fast sealift ships, the crane ships, and the two hospital ships. The maritime prepositioning program was also initiated in this period of time. With the exception of these programs, logistics did not share in the technology of the 1980s. Logistics was not included as a component of command and control systems. Software support programs for operational and tactical logistics were not developed. Nor did logistics claim any part of the increasing communications bandwidth becoming available. The software support programs which were written pertained to inventory and maintenance management and accounting, software which was administrative in nature rather than operational or tactical.

If one believes that operational planning is about 90% logistics planning, then, at the JCS level, logistics planning software was developed in the form of the Joint Operational Planning and Execution System (JOPES) and the Time-Phased Force Deployment Data (TPFDD) associated with any OPLAN. The TPFDD pertains to logistics in so far as it catalogues the forces and sustainment stocks which need strategic lift in the implementation of any OPLAN and the priority and timing of their movement. The joint planning systems address logistics planning but do not predict logistics sustainability.

This report is about the need for comprehensive logistics information for the Joint Forces Commander. Joint doctrine says that to exercise control at the strategic, operational and tactical levels of war, commanders must also exercise control over logistics. Control cannot be exercised without timely and comprehensive information, a picture of the battlefield logically speaking including not only what is already on the battlefield but what is flowing into it as well. Logistics did not receive a lot attention in the Department of Defense's efforts

to develop and apply technology in the years after the Vietnam conflict.

Despite the lack of attention, logistics was one of the successes of the Gulf War. However, success must be qualified by at least three favorable conditions which applied. Host nation support and facilities were superb. Stocks of forces, equipment, spare parts and maintenance capability were all at high levels, the legacy of the just concluded Cold War. A third qualification was that the Iraqi leadership defaulted the initiative in this conflict to the Coalition forces. As a result, we had the luxury of taking as much time as necessary to move forces and sustainment stocks to their in-theater operating positions. Still, there were a number of logistics problems and they will be examined below for their implications about the logistics picture needed by the joint forces commander.

### 3. THE GULF WAR

*"Gentlemen, the officer who doesn't know his communications and supply as well as his tactics is totally useless."*

General George S. Patton, USA

When Iraq invaded Kuwait on 2 August 1990, the U.S. Joint Forces Commander for this theater was CINCCENT, General Norman Schwarzkopf. General Schwarzkopf was at his headquarters at McDill Air Force Base in Florida. It took Iraqi forces less than 24 hours to secure their hold on the independent state of Kuwait. It was unclear as to whether the Iraqi forces would be content with their capture of Kuwait or whether they would press on into northeast Saudi Arabia. On the evening of 4 August CENTCOM commanders and planners met to rough out requirements if U. S. Forces were to be committed. Early on 5 August Secretary Cheney, General Schwarzkopf, and LTG Yeosock, ARCENT commander, flew to Riyadh for top-level meetings with King Fahd. On 6 August President Bush announced that U.S. forces would be committed to the defense of Saudi Arabia; the XVIII Airborne Corps was already mobilizing. On 8 August the first troops of the 82nd Airborne Division were arriving at the airport in Dhahran, Saudi Arabia. Also on 8 August the Eisenhower battle group was on station in the Red Sea and the Independence battle group was on station in the Gulf of Oman.

In early August 1990, the United States had no forces, bases, supplies or infrastructure in Saudi Arabia. Forces, their equipment, and their sustainment stocks of fuel, ordnance, spare parts and a million other things would have to be deployed into the theater and bases established for them. The CINCCENT operation plan (OPLAN) on the shelf was 1002-88 which involved Iran. In October 1989 the JCS had directed that a major revision of this plan be prepared with Iraq as the opponent. In April 1990 the outline for USCINCCENT OPLAN 1002-90 was published; the plan was completed in April 1991 after the operation was concluded. An OPLAN represents the full development of a CINC's concept of operations. It

specifies the forces and support needed to execute the plan and the transportation schedule required to move those resources. In developing a plan, the CINCCENT and service component staffs develop a detailed flow of resources into the theater to support the approved OPLAN concept. After forces are selected and time-phased support requirements are determined and transportation is computer simulated, the detailed planning information is generated and stored as a TPFDD. Clearly, in August 1990, CINCCENT had neither an approved OPLAN nor a TPFDD for the operations he was about to undertake. Worse yet, there had been no warning time and he was playing catch-up from the start.

Because it was not known that Iraq would not invade Saudi Arabia, General Schwartzkopf's initial concern had to be to put defensive forces into northeastern Saudi Arabia as rapidly as possible. CINCCENT decided to deploy combat units ahead of logistics support and sustainment cargo. Lacking an approved OPLAN and TPFDD, the Military Airlift Command's initial tasking consisted of an unprioritized list of units to be deployed as soon as possible. The situation was chaotic until CINCCENT established movement priorities. Thus began the implementation of the principal that the warfighter must have command of and must exercise control over his logistics.

Joint Logistics Doctrine states: Ref (3),

*"To exercise control at the strategic, operational and tactical levels of war, commanders must also exercise control over logistics. For a given area and for a given mission, a single command authority should be responsible for logistics, especially in the joint operational environment. The logistics support system must be in harmony with the structure and employment of the combat forces it supports. This unity of effort is best attained under a single command authority. . . . Commanders must be able to call forward in a timely manner those assets needed to initiate and sustain war."*

Operation Desert Shield began as the defense of Saudi Arabia and was ultimately to result in the liberation of Kuwait and involve more than 500,000 US forces from all the Services, plus Coalition forces. CENTCOM's ability to set transportation priorities and gauge its ability to defend Saudi Arabia and ultimately to free Kuwait depended upon having a picture of what forces, unit equipment, and sustainment material had arrived, what bases had been established, and the intratheater transportation assets available to move forces and material from their port of entry to their desired locations. In terms of personnel the Army was the dominant Service, but the picture needed to include the Air Force, the Navy, the Marines, and ultimately the Coalition forces. The feasibility and timing of Operation Desert Storm ultimately depended on knowing that the forces were ready, in the right places, and that their sustainment stocks were adequate for the task about to be undertaken. Some of the required information was tactical, some of it was readiness related, and a lot of it was logistical.

#### 4. LOGISTICS IN THE GULF WAR

*"During the last war, eighty percent of our problems were of a logistical nature."*  
Field Marshall Montgomery

When Kuwait was invaded in early August no OPLAN existed for this contingency. The lack of an OPLAN necessarily implied the lack of time phase force deployment data. While the deliberate planning process was underway, crisis action planning was of necessity employed. Presented with a fait accompli by Iraq, CENTCOM rushed defensive forces into Saudi Arabia beginning with the Marines and Army airborne forces. These were followed up by heavy forces whose arrival times were dictated by the availability of strategic sealift from CONUS and, later, Europe. Naval forces surged into the theater from nearby deployment areas. Air Force tactical aircraft were flown from CONUS directly into Saudi Arabia while their equipment and personnel were airlifted. Bases had to be created for the forces. Though existing air bases would be utilized by the Air Force, in some cases the air base was simply a runway with little or no infrastructure. Fuel systems, ordnance storage facilities, maintenance facilities, and housing for personnel all had to be created. These efforts were handicapped by the need to assign movement of forces a higher priority than the movement of combat service support. Fortunately, host nation support was rich in resources including air and sea ports to receive the inflow, tents to house personnel, and trucks and buses and drivers to move personnel, equipment, and supplies.

The early arrival of Marine Corps troops and Air Force squadrons was facilitated by the existence of prepositioned unit equipment and sustainment stocks on ships at Diego Garcia and, for the Air Force, additional ammunition storage locations ashore within Southwest Asia. There was a Phase I (the defense of Saudi Arabia) build up which lasted until approximately 1 November and a Phase II (the liberation of Kuwait) which brought the Seventh Corps from Germany to Saudi Arabia. In all, more than 500,000 personnel and 9.3 million tons of material were transported into the theater to support the Gulf War. LTG Pagonis, the Army's senior logistician, likened it to transporting the entire population of Alaska, along with their personal belongings and vehicles, to the other side of the world, on short notice, Ref (4).

CENTCOM theater logistics operations in support of contingency plans were based on the doctrine that each Service would train, equip, and sustain its own forces in the area of responsibility, Ref (3). Each Service was responsible for its own logistics, subject to common user support (such as water and food) being provided by the component having the greatest presence, the Army in this case. The Army provided food and water to in-theater forces of the Army, Air Force, and the Marines ashore. The Navy sustained naval forces and Marines afloat. Intratheater ground transportation was provided by the Army for itself, the Air Force, and the Marines who also had organic ground transportation. Air transport was provided by the Air Force for the three Services. Offloading of ships was handled by the Army Transportation Corps, by Navy Beachmaster units, and by the Marine Corps Landing Support

Battalion. Intertheater airlift was run by the Air Force Military Airlift Command (since renamed the Air Mobility Command), and strategic sealift was run by the Navy Military Sealift Command.

The logistics experiences of the four Services are summarized below. The lack of an OPLAN and its TPFDD hindered the movement of all but naval forces. Asset visibility, in-transit and otherwise, was a general problem. The Joint Forces Commander's decision to require 60 days of supply of everything in theater showed the ordnance logistics planning factors to be in need of revision.

#### **4.1 The Army Logistics Picture**

The Army logistics picture has been inferred from examination of a sample of the Logistics Situation Reports (LOGSITREPs) of the 22nd Support Command (SUPCOM) commanded by MG, later LTG, William G. Pagonis. General Pagonis went to Saudi Arabia at the request of LTG Yeosock, ARCENT commander, to head up host nation support negotiations, arriving there on 8 August. Over time, General Pagonis took charge and became the chief logistician of the Gulf War. Officially he was the commanding general of the 22nd SUPCOM of ARCENT. The daily LOGSITREPs of the 22nd SUPCOM were sent to ARCENT, CINCCENT, the Pentagon, and Army logistics agencies. While officially General Pagonis worked for ARCENT, there is little doubt that he believed that he was working for CINCCENT, General Schwarzkopf. Thus the 22nd SUPCOM LOGSITREPs probably represented the JFC's logistics picture throughout Desert Shield and Desert Storm.

Seven of the daily 22nd SUPCOM LOGSITREPs were obtained from the Department of the Army History Office at Fort Leavenworth. Notes on each of them are contained in the Appendix of this report. The LOGSITREPs are essentially about Army logistics and the common support logistics provided to the Air Force and Marines ashore. The LOGSITREPs contained virtually nothing related to the logistics of naval forces. The only Air Force and Marine Corps logistics data ever found in the LogSitReps pertained to rations, water and POL. Thus the daily 22nd SUPCOM LOGSITREPs were essentially about Army logistics. This is not unexpected because the 22nd SUPCOM was a component of ARCENT.

The lack of in-transit visibility of inbound shipments was evident in most of the 22nd SUPCOM LOGSITREPs. This was especially prevalent at the beginning of operations, but persisted throughout the conflict. Without in-transit visibility they could only track, and could not predict, the logistics situation. Asset visibility was also a problem. Of the more than 40,000 containers deployed to the theater, well over half had to be opened, at least once, to determine its contents, ownership, and destination, Ref (5). There is a story that after the war had ended and the redeployment operation had begun, 25,000 containers had to be opened to determine their contents before they could be retrograded. One of the discoveries was the pumpkin pies intended for previous holidays. Had the contents been material more vital to the

war effort, this story would not be amusing.

In general the LOGSITREPs were organized in terms of Commodity Classes as follows.

Class I	Subsistence items
Class II	Clothing, Individual Equipment
Class III	Petroleum, Oils, Lubricants (POL)
Class IV	Construction Materials
Class V	Ammunition
Class VI	Personal demand items
Class VII	Major End-Items
Class VIII	Medical supplies
Class IX	Repair Parts
Class X	Material for non-military programs

Commodity classes I (rations and water), III (fuel), V (ammunition), and VII (major end items) received the most attention in the LOGSITREPs with water, fuel, and ammunition generally considered as the logistics drivers. The numbers of end-items (aircraft, tanks, artillery) was of interest and the operational status of these systems got more detailed attention as Desert Storm approached. As the Service with greatest presence, the Army was responsible for the subsistence of the Air Force and Marine Corps personnel ashore, and for the in-theater distribution of Air Force fuel and ordnance, and Marine Corps fuel. This made transportation assets (trucks and buses) items of great interest as well. People and mail are not commodities, but both had to be received and distributed within theater and thus are reported in the LOGSITREPs as well.

Air Port Of Debarkation (APOD) and Sea Port Of Debarkation (SPOD) information was displayed in terms of the number of flights that day and to-date or number of ships arriving that day and to-date. Cargo was reported as passengers, aircraft, vehicles, pallets, or containers. These were raw numbers, not associated with the units to which the passengers, equipment, or commodities were destined. There was no indication as to how the receipt of cargo related to the "plan." Hence performance could not be evaluated. Of course, there was no plan (no OPLAN or TPFDD) with which to evaluate the deployment surge. This was clearly not a crucial point given that Iraq did not move forces across the border into Saudi Arabia and thus the Coalition had all the time it needed to build up its forces. The timing of Desert Storm was dictated by the policy decision that there would be no troop rotation, concern about how long the Kingdom would allow foreign forces in their country, the coming of the Spring rainy season, the UN resolution, and how long it would take to position the necessary forces and their sustainment materials in country.

For two of the three logistics drivers, water and POL, the LOGSITREPs reported

present status in terms of capacity, on-hand quantities, and, sometimes, the days of supply and a 5-day forecast. Water and POL status was given for ARCENT, MARCENT and CENTAF, though not all the reports had information on other than ARCENT. The notion of trying to project ahead was in the spirit of providing really useful information, but none of numbers ever changed; i.e., the expected quantities for each of the days in the 5-day forecast were the same as the current day numbers. The forecasting capability did not really exist. The third logistics driver, ammunition, was usually noted in terms of the number of short tons or truck loads received or distributed within theater. The operational commanders would have wanted to know how much of each specific ordnance type they had available and perhaps this level of detail was available because the later LOGSITREPs did report the number of rounds of each ammunition type by Corps.

Days of supply is a convenient way of converting a quantity, of rations or water, say, into operationally meaningful terms. A quantity can be converted into days of supply if the population data and planning factors (consumption quantity per man per day) are known. MARCENT and CENTAF rarely reported population data to the 22nd SUPCOM.

End-item or equipment status was generally given in terms of the number authorized, number on-hand, number mission capable, and the operational ready rate. During the Fall, the majority of not-mission capable systems were awaiting delivery of repair parts. By December, there was a shift wherein the majority were awaiting maintenance availability rather than repair parts. Only Army end-items appeared in the LOGSITREPs. As the ground war approached there was massive movement of personnel, equipment and sustainment stocks and this was reflected in the declining mission capable rates of organic and host nation trucks and buses.

#### 4.2 Air Force Logistics in the Gulf War

The Gulf War Air Power Survey, Volume III, Logistics and Support, evaluated Gulf War logistics performance from the Air Force perspective, Ref (6). It notes that it was the JFC's decision to deploy "tooth before tail," and that this created interesting logistics challenges given that forces were deploying to an area devoid of U.S. military bases or infrastructure. The lack of an OPLAN and TPFDD clearly was a challenge. The Survey concludes that, initially, logistics operated without confirmation of priorities and with insufficient details to deploy efficiently. CENTCOM and TRANSCOM had to build TPFDD data and enter it into JOPES even as it was being executed. Hundreds of units of all of the four Services were submitting data or making entries in the TPFDD. The entries had so many errors that they were unreliable for determining lift requirements. It was discovered that JOPES could not track partially deployed unit type cases thereby making automatic tracking of what was deployed and what was not impossible. It was also noted that the Military Airlift Command's computer models could not analyze schedules and determine where flow would exceed throughput capacity. This led to several system shutdowns until the logjams cleared. Cargo caught in the backlogs was often assumed lost and was reordered.

The Survey states that abuse of the transportation priority system created many problems. In early September 1990, 52% of all sustainment cargo awaiting air shipment was coded at the top transportation priority level creating a situation wherein there were essentially no priorities. The lack of prioritization and the presence of desired closure times of "now" created an air lift demand which was six to seven times air lift capacity. The air lift that was provided was constrained by the nearly useless automated information systems. Because tooth was deployed before tail, many units did not know where they would bed down and the only address on their cargo was "Desert Shield." Most of these ended up in Dhahran where pallets sat and no one knew their intended destination or priority. They noted that CENTCOM's decision to increase sustainment level from 30 days of supply to 60 days of supply didn't help. The JFC's authority to set sustainment levels is clearly indicated in Joint logistics doctrine, however. Separately, Army General John Foss noted in 1994, Ref (7), "Probably the very worst decision of Desert Shield/Desert Storm was the decision to stock 60 days of supply and ammo in-country. It drove up force structure, it cost the Army lots of money and time, and over 90% was backhauled." General Foss' comment notwithstanding, sufficiency is a principle of logistics and 60 days was approximately the time required to get ordnance delivered into the theater from CONUS depots.

The Survey noted that Service supply and transportation systems had deadly deficiencies in in-transit visibility. Within supply systems items were tracked by requisition number. A different, separate control number was assigned to track items within the transportation system. With no mapping of requisition numbers to transportation control numbers and massive amounts of material being moved, all traceability was lost. The Air Force Logistics Information File, modeled after the Army Logistics Information File and available late in the war, linked supply and transportation systems to provide intertheater in-transit visibility and helped fix the problem of losing track of parts as soon as they entered the transportation system. Another fix was the Desert Express flights from CONUS into theater. Desert Express was necessitated both by the priority abuse problem and the in-transit visibility problem as they affected "war stopper" material.

There were significant problems with ordnance inventory information. The information was created and maintained by hand throughout the Gulf War. Because ordnance tracking was done manually, there were significant inaccuracies and the lack of credible information for senior Air Force managers. The \$100 million that had been spent on the Air Force Combat Ammunition System was of no benefit to users. The Survey also noted that information on the ordnance cargo of arriving ships was the "mother of all mysteries."

With regard to aircraft mission capable rates, the Survey noted that they were nearly as good as peacetime rates but not better and that the higher rates originally reported were the product of an ad hoc reporting system. With regard to maintenance, automated maintenance management support was not available until December and the absence of aircraft status information hampered attempts by various headquarters to determine the health of the fleet.

The absence of configuration data, especially for engines, further compromised their ability to perform maintenance. Finally, the Survey concluded that the Cold War resource base that made virtually anything possible in the Gulf War is being reduced, and the five and a half months to prepare for war should not be a planning assumption for future conflicts.

#### **4.3 Marine Corps Logistics Ashore in the Gulf War**

The Marine Corps deployment in the Gulf War was hampered, like everyone's, by the lack of an OPLAN and TPFDD. It was however a brilliant confirmation of the efficacy of Maritime Preposition Ships. The MPS squadron at Diego Garcia was ordered underway on 10 August and arrived in the port of Al Jubayl on 16 August. The 7th MEB personnel were flown in, married up with their equipment, and were in defensive positions north of Al Jubayl by 25 August. The Army 82nd Airborne Division had troops on the ground earlier, but the Marines offered the first credible deterrence to a mechanized attack.

Al Jubayl was the Marines' sea port of debarkation and the nearby King Abdul Aziz airport was their APOD. The port of Ad Dammam, 50 miles to the south, was the Army's SPOD. The Marines deployed somewhat differently from the Army. By 6 September, Brigadier General Brabham had enough combat service support personnel in Al Jubayl to stand up the 1st Force Service Support Group, assume responsibility for all port operations, and command of host nation, Army, and Navy material handlers as well as the Marine Landing Support Battalion. Marine Corps 7th MEB helos arrived by C-5 airlift, but Marine tactical fixed wing aircraft were stalled on the East Coast for lack of Air Force tankers for in-flight refueling. LTG Boomer finally asked for General Schwartzkopf's help in securing the Air Force tankers needed and Marine F/A-18s began arriving in theater on 23 August.

The biggest Marine Corps logistics problem was related to intratheater ground transportation rather than organization, information, or the availability of sustainment stocks. As the Marine defense perimeter moved out from 30 miles north of Al Jubayl to 80 miles north, and eventually to considerably farther west, the lack of trucks and truck drivers was evident. Prior to the Gulf War, Marine Corps truck units expected one-way line haul distances of 30-50 miles and experienced distances of 175-200 miles in the Gulf, Ref (8). There were not enough trucks and not enough drivers to keep the available trucks running 24 hours a day. The Marines had no Heavy Equipment Transporters (HETs) and had to drive their tanks from port to their deployment areas. (The Army had only a few and leased HETs from every available source.) The Marines leased trucks and buses, called up the reserves to gain additional truck drivers, relied on the Army for line haul of its fuel, used Air Force C-130s and their own CH-53 helos for logistics, and even used Army boats to ferry material and equipment up the coast from Al Jubayl to Ras al Mish'ab.

The Marine Corps Generals involved all said that fuel, ordnance, and water were the commodities that drove the logistics situation, Ref (9). Ordnance was often of highest

concern. General Brabham noted that 30 days of supply (DOS) of ordnance for the Marine forces was 265,000 short tons (and of course the 60 DOS ordered by CINCCENT was 530,000 short tons). Moving ordnance put a tremendous strain on available Marine Corps intratheater transportation assets. LTG Moore, Commanding General of the Third Marine Aircraft Wing, had a different ordnance problem; he almost ran out of bombs, Ref (9). On Thanksgiving Day he wrote a message with himself as action officer to everyone in the bomb-family chain of command giving his requirements for 60 DOS. One reply indicated that since the 3rd Marine Air Wing was a Pacific wing, he could have only the Pacific ordnance allocation and he could not have the Atlantic allocation. He responded that he had both Atlantic and Pacific squadrons and that, in case they had failed to notice, he was about to be involved in a war. Several weeks went by and he received a message saying "we don't think you need so many Mk 82 bombs." At one point during the war, he was down to 0.5 DOS of Mk 82 bombs and 1.5 DOS of Mk 83 bombs before resupply by ship was received. He went on to say that he ended the war with a 14 day supply of ordnance. He also estimated that 25% of sorties flown lacked the preferred ordnance that would have increased target kill probabilities.

#### 4.4 Navy Logistics in the Gulf War

Navy afloat logistics differ little in war from logistics in peacetime. The principle difference is that ordnance is used in war and must be resupplied to afloat forces in wartime. NAVCENT had difficulty in determining the ordnance situation throughout the war. The Navy Conventional Ammunition Integrated Management Systems (CAIMS) was created as an ordnance accounting system and was unresponsive to operational commanders in the War, Ref (10). Its data were of substandard quality. In peacetime, month-to-month variations of 10% or more in the total number of weapons of a given type reported in CAIMS were not unusual. These were variations that could not be accounted for by new production or changes in the material condition of the inventory. Instead, such variations are due primarily to mismatches in the reporting of issues and receipts that had not been corrected. This problem was exacerbated during the buildup and war when mismatches increased dramatically along with ordnance transfers, outstripping the ability of the people maintaining the system to rid it of errors.

Further, the organization and presentation of the data in CAIMS made it difficult to track inventories of commands other than the fleets and numbered fleets. CAIMS could not provide inventory totals for component commands such as NAVCENT or MARCENT. Nor could it provide totals for operational commands such as task forces or task groups. Finally, NAVCENT did not have a CAIMS terminal and could get CAIMS data only through CTF-63 or CTF-73 (the 6th and 7th Fleet logistics organizations), CINCPACFLT, or CNO (N-4). The impact of these circumstances is that operational commanders never had good ordnance inventory data and in some cases rationed their use of certain ordnance when in truth there was no reason to have done so.

Another logistical problem involved the distribution of people, mail and cargo to operating forces from the Navy's forward logistics site in Bahrain. Because logisticians in Bahrain had no information about the location of tactical units, they did not know where their customers were and were unable to expeditiously distribute people or cargo to them as a result. This situation remains unchanged as indicated by the problem recurring as recently as Exercise Strong Resolve in 1995.

Communications for Navy logistics was also a problem. Supply Corps officers attempting to provide the spare parts needed to correct equipment casualties had to rely on standard Navy messages to relay their needs in theater to CONUS inventory managers. When the volume of messages generated grows large, so does the time it takes for a message to be received. The Streamlined Automated Logistics Transmission System (SALTS) was devised by two Supply Corps reserve officers to get around the delays in message traffic. SALTS uses a personal computer to format messages and the commercial INMARSAT service to transmit the messages. INMARSAT (B) costs \$12.90 per kilo bit second (Kbps)-hour, Ref (11). Also INMARSAT is unclassified transmission only. The Navy is now installing T-1 satellite connectivity to carriers, command ships, and big deck amphibious ships to support imagery, global video conferencing, telemedicine, secure voice communications, and pay phones for the crew. Note that no use of this capability is envisioned for logistics. The T-1 connectivity is also known as Challenge Athena. Its cost is \$0.18 per Kbps-hour. New on the horizon is the General Broadcast System on UFO (UHF Follow-On) with a cost of \$0.05 per Kbps-hour. Relative data rates are 16 Kbps for INMARSAT, 1.544 Mbps for Challenge Athena, and 23 Mbps for GBS on UFO. Communications to support logistics command and control exist or will exist in the near future.

#### **4.5 Summary of Gulf War Logistics**

The Gulf War was a success by any measure, including logistics. No forces lacked for sustainability and logistics did enable execution of the CINC's operational plan. Still, there were logistics planning and execution problems. Efficient deployment was hampered by the fact that there was no approved OPLAN and TPFDD when the crisis began. JOPES was new and the TPFDD input process was too ponderous for crisis action planning. Initial execution was done without JOPES and TPFDD files were frozen. Air Force General Walter Kross, Director of Operations and Logistics (J-3/J-4) at U.S. Transportation Command when the Gulf War began, said that on day 4 JOPES/TPFDD went into gridlock and his worst nightmare ensued--having to try to do the job with pencil and paper. JOPES came back on line on 24 August and around 28 August the TPFDD was stable enough to use as a basis for planning. Deployment planning focuses on moving the maximum amount of forces and their support into the theater in the minimum amount of time. Current deployment planning tools do not address distribution within the theater, and intratheater distribution was hampered by insufficient surface lift capability and the fact that initially bed down locations were not known. In-transit visibility of the things being airlifted and sealifted into the theater was an early and persistent

problem. Lack of knowledge about what was coming into theater ports meant that LTG Pagonis could only track the material which had arrived and could not project what the status would be a week or a month ahead. Ordnance was a logistics driver and problems included determining requirements, and the inability of the component commanders to determine how much ordnance of each type they had available. Thus, there appears to have been little ability to create a comprehensive logistics picture for the Joint Forces Commander.

The lack of an OPLAN and its TPFDD affected the deployment. The performance of airlift and sealift could only be tracked and could not be judged against the plan. Basically the mobility *requirement* became the mobility *capability*. Judging unit closure could not be done directly because JOPES could not track partial unit movements. This combined with asset visibility problems meant that predictions about unit closure and sustainability could not be made. Further, it is not apparent that prediction software was available to accept intertheater lift plans and combine them with intended unit locations and intratheater lift capability. Much of the information about what was arriving at SPODs or APODs was simply reported as numbers of personnel, equipment, and tons or truckloads. Without associating these things with the unit to which they were intended, where those units were to bed down, and intratheater lift capability, unit closure could not be predicted. Where ordnance receipt or movement was reported in tons or truckloads, the ordnance sustainability of individual units or forces could not be predicted in terms of the days of supply of high-interest ordnance items.

Of the 9.3 million tons of equipment and material shipped in support of the Gulf War, about 6 million tons was POL. Ordnance accounted for a fair proportion of the other 3.3 million tons of material shipped. With imperfect intelligence about the enemy and sufficiency as a guiding principal in determining force levels and sustainment stocks requirements, the amount of ordnance shipped into the theater was far greater than the amount used. The Air Force, Ref (6), says it used 69,000 tons of the 350,000 tons of ordnance shipped into the theater for the Air Force; that is, they used about 20% of the ordnance shipped. Other estimates are that only between 1% and 5% of the total amount of ordnance shipped was used. Whatever the correct numbers, it is clear that there was, in gross tons of ordnance, an ample amount so that the risk of running out of ordnance was minimal. A tremendous amount of effort, however, went into moving unneeded ordnance into the theater and then retrograding it. Clearly only better intelligence and a better requirements determination process, not just an improved capability to track logistics flows, could have narrowed the gap between the amount of ordnance shipped and used.

The current doctrine for logistic support of joint operations, Ref (3) as well as its earlier versions which were in effect at the time of the Gulf War, says that logistics is a command function and that there should be a single command authority responsible for logistics. It also says that each Service is responsible for the logistic support of its own forces. Operation Desert Shield/Desert Storm was run with each Service component responsible for sustaining its own forces. There was no single command authority for logistics. In his book,

Ref (4), General Pagonis says that the third star he was awarded during the Gulf War "symbolized the importance of a single and authoritative logistics point of contact." His command, the 22nd SUPCOM, did represent the single point of contact for Army logistics, but he had little information about Air Force, Marine Corps logistics, and absolutely no information about Navy or Coalition forces logistics. Thus there was no comprehensive logistics picture for the Joint Forces Commander.

## 5. Logistics Initiatives since the Gulf War

*"Clearly, logistics is the hard part of fighting a war."*

Lieutenant General E.T. Cook, USMC, II MEF Commanding General  
in the Gulf War

Logistics does not normally receive a lot of attention once a conflict is concluded. During conflict, logistics rises in everyone's awareness but it usually recedes quickly once hostilities are ended. Logistics has not been relegated to oblivion in the time since the Gulf War, however. Logistics was big in that conflict and many of the problems recited earlier in this report have received attention for several reasons. The size, cost, and time required to build up the force and logistical posture called for by the joint force commander were all impressively large. Because of the sensitivity of the host nations to having large numbers of non-Arab personnel in their country, the size of the "footprint" of our forces and their logistics looked like a liability. Then too, the size of the footprint meant that there were a number of very attractive targets that could have been attacked by a more capable enemy. These considerations, merged with the vision of a revolution in military affairs, have generated interest in streamlining logistics.

A further reason for post-conflict interest in logistics at this time is economic in nature. With no clear, capable enemy in the post-Cold War environment and with concern for budget deficits, the decline of the Defense budget begun in FY 1985 has accelerated. While force structure (personnel, ships, aircraft squadrons, army divisions) has been significantly reduced, modernization of the remaining forces will be underfunded unless further economies can be found in infrastructure and operations. Thus smaller, more responsive logistics that also require less investment and operating funds are being aggressively pursued. The notion that the Services should adopt advanced business practices abounds in the current literature and discussions. Information is the key to the re-engineering of logistics needed.

Heading the list of Gulf War logistics problems perhaps was asset visibility including in-transit visibility (ITV). Initiatives here have resulted in prototype ITV capabilities that were used as early as the operations in Haiti and are in use in connection with Operation Joint Endeavor in Bosnia. ITV component systems consist of the TRANSCOM Global Transportation Network (GTN), the Defense Automatic Addressing System - CONUS Freight

Management (DAAS CFM), the Air Force Consolidated Aerial Port System II (CAPS II), and the Army Movements Management System (DAMMS-R). Technology includes radio frequency tags that record the contents of a container or air pallet and are affixed to the cargo. The tags are capable of transmitting their data when queried by fixed or hand-held interrogators. The shipping industry has been using this technology for many years. Beyond the tags and interrogators, the keys to an effective information system are a relational database, standardized electronic data interchange (EDI), and wide area communications capability allowing all commercial and military databases and tracking systems to transmit data into the GTN, Ref (12).

Efforts to create smaller, more responsive logistics operations are underway in the Army under the name of Velocity Management and in the Air Force under the name of Lean Logistics. The goal of Velocity Management is to make Army logistics as fast and efficient as a Fortune 500 company, Ref (13). Velocity management focuses on responsiveness. It is postulated that moving supplies is cheaper than stockpiling. The Army Materiel Command has stockpiles worth \$59 billion. Still commanders note that civilian distribution systems meet customer demands within 2-3 days while it takes the Army logistics system 26 days. The first target of the Army Velocity Group was thus order and ship times (OST). Significant reductions in OST were achieved in the first year (1995), but the stated goals, 7 days for CONUS high-priority requisitions and 15 days for high-priority overseas requisitions, Ref (14), will hardly excite any Fortune 500 company. Velocity Management is also looking at repair cycle times, the processes which determine inventory stockage objectives, and battlefield distribution Ref (15).

The Air Force's Lean Logistics initiatives have goals similar to those of the Army velocity management initiatives: namely, to make logistics simultaneously more effective and more efficient. The Air Force is moving from a supply (inventory)-based logistics system to a transportation-based system. The Air Force is leveraging fast logistics cycle times and reductions in logistics cycle variability to shrink stockpiles of their most expensive spare parts. Initial focus of Lean Logistics is to reduce cycle times in all segments of the repair pipeline. They also see information as the key to process improvements. Ref (16).

The objectives of both Velocity Management and Lean Logistics are to improve logistics system responsiveness while reducing stockpiles, facilities, and the personnel involved in the present logistics systems. Saving money and reducing footprint and vulnerabilities are clearly desirable byproducts as well. This sounds like a win-win situation. It can be achieved by improving the performance of the logistics systems and the key to improved performance is information, timely information about assets held, assets needed, and transportation capabilities.

The Navy is developing concepts for Sea Based Logistics to support the Marine Corps Operational Maneuver From The Sea. The objective is a reduced footprint ashore to minimize

vulnerability. Reducing shore based logistics would also reduce manpower ashore and result in lighter, more agile tactical forces operating on shore. "Sea Based Logistics becomes reality with the fusion of four key changes to the way we operate and provide sustainment. The first is operating from a base of ships at sea where we might ordinarily establish a base of operations on shore. The second involves wholesale reductions in logistic demand. The third is implementation of in-stride sustainment. The last is the ability to smoothly transition to joint and much larger operations," Ref (17).

The Service initiatives for smaller, more efficient, more effective logistics dovetail with the road map for future joint warfighting laid out by the Chairman of the Joint Chiefs of Staff in Joint Vision 2010. Information superiority is seen as enabling the operational concepts of Dominant Maneuver, Precision Engagement, Full-Dimensional Protection, and Focused Logistics. "Focused logistics will be the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while en route, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical level of operations. Information technologies will enhance airlift, sealift, and pre-positioning capabilities to lighten deployment loads, assist pinpointing logistics delivery systems, and extend the reach and longevity of systems currently in the inventory. The combined impact of these improvements will be a smaller, more capable deployed force. It will require less continuous support with a smaller logistics footprint, decreasing the vulnerability of U.S. logistics lines of communication," Ref (18).

Logistics has not returned to being a somewhat dormant subject since the Gulf War. Still, the efforts described above, though they depend on greater use of information technology, do not directly address the subject of logistics command and control. However, there are several additional initiatives underway which do address logistics command and control.

Late last year the Secretary of Defense described a technology demonstration being conducted by the Army's Experimental Force (ExFor), Ref (19). ExFor is based on the application of digital C4I technology to existing armor, mechanized, and infantry battalions. The 4th Infantry Division based at Fort Hood, Texas, is currently serving as the ExFor. Within the division, one armored brigade with an attached light infantry battalion has been designated as Task Force XXI and refitted with the new equipment. In this demonstration every vehicle (land and airborne) was equipped with a Global Positioning System, sensors for "seeing" the battlefield, and a tactical Internet connection. Every vehicle had the capability to send its position and what it sees to the commander and to receive and display the fused picture created from the information from every other vehicle on the battlefield. Since what was being seen included the enemy as well as other 4th ID units, the result was real battlefield awareness, and the basis for a command and control system for the commander.

The ExFor technology demonstration is relevant to logistics command and control

because the logisticians are included in the tactical Internet and each vehicle in the force is broadcasting its levels of fuel and ammo to them. With nearly real-time information about who needs what, the logisticians are empowered to be proactive (focused) in providing the right stuff, to the right place, and at the right time.

A second initiative is that of the Defense Information Systems Agency (DISA) which notes that the joint task force does not have integrated combat support capabilities. DISA is therefore developing the Global Combat Support System (GCSS) to provide interoperability across combat support functions, as well as between combat support and command and control functions, Ref (20). The combat support applications to be included in GCSS include asset visibility, logistics, finance, procurement, medical, transportation, and personnel. This is a very wide range of applications. System characteristics will include a common hardware and software environment, shared databases, and communications.

The focus of this study is combatant logistics for the joint forces commander, the warfighter. It is useful to distinguish between what is operational or tactical and what is administrative. The warfighter needs what is operational and tactical. Finance and procurement as GCSS applications are thought of as administrative and not of first order importance to the warfighter. Maintenance is thought of as operational, though not presently addressed in GCSS. Finally it appears that the present goal of GCSS is to track the status of the activities in its application areas.

The two dominant characteristics of the logistics initiatives described in this section are that what is reported is *data* and the data is for purposes of *tracking* something. As will be argued in the next section, the goal for a combatant logistics command and control system should be the ability to process data to produce *information for planning, tracking, and prediction*.

## 6. CLCC SYSTEM REQUIREMENTS

*“Forget logistics, you lose.”*

General Frederick Franks, USA, VII Corps Commander in the Gulf War

This section is about the information and evaluation capabilities needed in a combatant logistics command and control system. This section is not about technical attributes. The Focused Logistics Roadmap, Ref (20), states that the six essential technical attributes are: 1) any box, 2) any user, 3) one net, 4) one picture, 5) common services, and 6) robust communications infrastructure. These are not trivial issues but at least they have communities who are advocates for the various technologies involved.

### 6.1 The Logistics Information the Gulf War Commander Needed

One can ask what General Schwartzkopf would have needed to know about his logistics

situation in the Gulf War. It has already been postulated in this report that the feasibility and timing of Operation Desert Storm depended on knowing that the forces were ready, in the right places, and that their sustainment stocks were adequate for the task about to be undertaken. Should the initiative not have rested with the JFC or if Iraq had invaded Saudi Arabia at some time during the Fall of 1990, he would have had to know the closure status and location of all forces as well as their situation with respect to fuel and ordnance in order to evaluate his own alternative courses of action.

Thus it is postulated that General Schwarzkopf needed unit closure information while the deployment surge was underway. A unit is considered closed when a high percentage of its personnel, equipment and sustainment material are in place at their assigned physical location in theater. For units which had not closed as of a given time, he would require a prediction of when closure would occur. A unit is not considered "capable" of its assigned missions until closure has been achieved.

Once a unit has closed, the JFC needs their Status of Resources and Training System (SORTS) data. SORTS is the principal report within the U.S. Armed Forces to provide unit location, identification and general status to the National Command Authority, the Joint Chiefs of Staff, Commanders-in-Chief (CINCs), and other operational commanders. Unit location in theater is also needed. This may sound obvious, but in the early stages of Desert Shield, unit location was being assigned in real time and units were relocated as the force buildup evolved. Updating is to be reported within four hours of any change in status. SORTS categories include personnel status, supplies on-hand status, equipment status, training status, status in each primary mission area, and overall status. Status is reported in terms of C-ratings. C1 is interpreted to mean that a unit is capable to undertake the full wartime mission for which it was organized. C5 is the lowest rating and indicates that the unit is unprepared to undertake wartime missions. There are also Mission Area ratings, M1 through M5, for each of the primary mission areas specifically assigned to the unit.

The JFC also needs information about end-item status in greater detail than that provided in the SORTS C-rating. End-item is the term being used here for major systems, platforms, or vehicles; i.e., ships, aircraft, tanks, artillery, air defense missile systems, etc. Such information is usually displayed in terms of the number which are fully mission capable and partially mission capable, and the operational ready rate which is the number that are fully or partially mission capable divided by the total number of such systems. For systems which are not mission capable, there is also the need for information about whether they are not mission capable awaiting maintenance (NMCM) or they are not mission capable awaiting spare parts (NMCS). This data needs to be reported daily and at the unit and individual end-item level. The information can be aggregated to whatever level is desired at a given time, but the CLCC system should have unit and end-item detail available and on call.

As an example, barrier breaching and mine clearing equipment availability was at one point crucial in planning the Gulf War ground campaign. Originally there was only enough such

equipment for a single Corps and the plan at that time was to breach with one of the two Corps and then pass through the other Corps. Everyone hated this plan. Eventually the amount of breaching equipment in theater grew large enough to allow each Corps to undertake breaching operations. Having such equipment on the list of important information is situation specific, but the CLCC system must possess the ability to tailor the logistics picture to the needs of the JFC at any time.

Information about sustainment stocks is also vital to the JFC who must judge whether forces have the necessary sustainability for the operations at hand. Fuel (or water) stocks stated in terms of tons, barrels or gallons or ordnance stated in terms of tons, truck loads or rounds need to be converted to a more operational measure. Through the use of appropriate models and planning factors, each can be converted into days of supply (DOS) which is thought to be a meaningful measure to the JFC. Gallons of water can be translated into DOS by dividing the quantity in gallons by the gallons per man per day planning factor times the population to be sustained by the water supply, with suitable reservation made for water to be used for decontamination purposes. Since it is not good enough to have sufficient fuel or ordnance in theater but not in the hands of the users, reporting of fuel and ordnance needs to be available at the unit level of detail even if eventually aggregated. Clearly the CLCC system must have the flexibility to report any commodity which the JFC thinks is critical.

The JFC also needs to know the capacity of his intratheater lift. This depends on the number of aircraft and air fields, rail lines and rolling stock, trucks, drivers and highways, and ships and port or logistics-over-the-shore (LOTS) capabilities. It is not just numbers of transport vehicles and facilities however. Capacity is something which takes numbers of vehicles and facilities as inputs and outputs tons, people, or vehicles that can be transported in units of miles per day. This relates not only to getting sustainment stocks to the users in the field, but also to moving the forces to where the JFC has determined that they need to be. Transportation capacity will vary over time during a campaign as a function of our own capabilities, infrastructure improvements, enemy actions, and simply wearout.

When General Schwartzkopf asked LTG Pagonis on 27 December 1990 if new logistics bases could be established and stocked and the two Corps repositioned between the 16th of January and the first of February to support the "Left Hook" flanking maneuver, General Pagonis had to rely on the factual information known to him at that time and his years of experience. He knew that the Pentagon would supply anything it could, but he also knew that he and the other Services had already contracted for nearly every truck and bus the free world had to offer and, in any event, there were only two paved highways over which the hundreds of thousands of troops and tons of material and gallons of fuel could be transported. (And yes, in execution it wasn't solely surface transportation; Air Force C-130s averaged more than twice the normal planned wartime sorties per day during this period.) General Pagonis responded that he could not accomplish the move within the time allotted and agreed to meet again in two days after he and his staff wrestled with determining how long it would take. In those two frantic days the General and his logistics cell "used every precious minute reshuffling and reshaping, cutting and pasting

the plan", Ref (4). There was no database or software for planning or predicting intratheater movement capability. General Pagonis, at the meeting on the 29th, stated that it would be possible to accomplish everything necessary if 21 days, rather than 14 days, were allowed.

Determining transportation capacity will require a fairly comprehensive, computer-based model. The Army has been developing what is called the Knowledge Based Logistics Planning Shell (KBLPS), Ref (21), and one of its capabilities is to recommend shipment transportation routes. Thus KBLPS or some of its structure may be a starting point for the intratheater transportation capacity model needed in a CLCC system.

## 6.2 CLCC System Data and Planning Factors

A CLCC system would necessarily be based on common data definitions. This has to be done smartly and not just represent "sameness" for its own sake. For many commodities (food is a good example) a consumption planning factor in terms of pounds per man per day is quite reasonable. Everyone wants to eat every day, whether the force is engaged or not, on the offensive or in a defensive posture. Water requirements measured in gallons per man per day is similarly very reasonable. Ordnance use planning factors in tons per unit per day however is only partially reasonable. It may be reasonable for determining gross transportation requirements. Beyond this, operational planning requires ordnance use planning factors for each specific type of ordnance and each phase of the operation. Pounds (or equivalently tons or units) per man (or unit) per day can be a useful metric for some types of ordnance and not for others. It may be useful for ordnance with daily level-of-effort use. It is not useful for threat weapons used in response to the enemy's initiative. A planning factor whose units are pounds per man per day is completely inappropriate for both Army Patriot missiles and for Navy Aegis system Standard missiles. Every aspect of "pounds per man per day" is wrong for such ordnance, but emphasis here is on the per day dimension; it should be *per event* where the event is an enemy action. Hopefully this sounds intuitively reasonable, but current JCS logistics planning factors for Patriot or Standard missiles use are in units of "pounds per man per day." This a metric developed during the Vietnam era when MACV asked the JCS for help in planning logistics and the only things the contractor could get for data were the tons of stuff shipped into that theater and the population of forces in theater. It is time to do better.

Whatever the consumption planning factors, they have to make sense to the Service and to the Joint Forces Commander. That is, the system should produce data which is useful to the Service producing the data as well as to the JFC. The JCS planning factor for ship fuel use is "gallons per ship per day," a single number independent of whether the ship is in transit at 20 knots or loitering on station at 8 knots. The single number is used presumably for simplicity. To the extent that the goal in logistics is to have the right material available at the right time and place, the use of highly aggregated averages is both inefficient and risky.

As already noted in connection with the 22nd SUPCOM LOGSITREPs, reporting ordnance quantities in terms of truck loads or short tons is not terribly useful. While it is desirable

to be able to roll up data from the detailed to the broad categorical level, the detail is important and necessary. Reporting that X tons of bombs are available is misleading if the truth of the situation is that they are all 500 pound Mk 82 bombs and that Mk 83 and Mk 84 bombs are not available, or if there are lots of bombs but no laser guided bomb kits. Everyone, the Service component commander and the JFC, wants to know the detail if there is a problem and the system must be built around such detail. The word logistics is from the Greek *logistikos* which does not mean the maintenance and movement of forces, but rather means skilled in calculation. Logistics necessarily involves a lot of detail and calculation even if the details are eventually aggregated into a green-amber-red presentation format.

Similarly fuels need to be reported in detail. Quantities of fuel may be reported in tons, barrels, or gallons. Tons are significant to the transporters, pounds are the unit of choice for aviators, and barrels or gallons are probably more useful to sea or land-based operational forces. Is this discussion of units of fuel measurement important? The author participated in exercise Ulchi Focus Lens 96 with the U.S. Seventh Fleet. At one point during the exercise, CTF 76, the amphibious forces, were surprised to be informed by the game controllers in Seoul that the amphibious ships were out of F-44 jet fuel. This was clearly not the case. Follow up determined that RESA, the computer-based war game being used by the controllers, treated F-44 in pounds only. Ship F-44 capacities in gallons had not been converted to pounds (1 gallon equals 6.71 pounds) and thus RESA and the controllers were understating ship F-44 capacities by almost a factor of seven. Once the controllers understood the problem, they attempted to input amphib F-44 capacities in pounds but found the field for this data in RESA too short to accept the corrected data.

### **6.3 CLCC System Functionality**

The system, if it is to have real value to the Joint Forces Commander, should have the capability to plan, track, and predict logistics information pertaining to planned or actual operations. All of these capabilities involve more than the display of available data. They involve software which can convert data into information through the use of logistics models of the processes involved.

It is often noted that operational planning is about 90% logistics planning. The Services have planning systems, but the one that counts is the JCS JOPES and its associated TPFDD. The plan for the deployment surge associated with any Operation Plan resides in JOPES. Because it is postulated that closure information is crucial, this information should be available within the CLCC system. The *Focused Logistics Roadmap*, Ref (22), notes that “The 3-series designation (of the forthcoming Joint Publication 3-35, Joint Deployment/Redeployment Doctrine) recognizes deployment as the first obstacle to effective combat operations, bringing increased attention to the deployment phase by both logistics and operations communities.” It further states that “The Defense Advanced Research Projects Agency’s Advanced Logistics Program is already exploring opportunities to converge operations and logistics information systems as an operational plan is executed.”

<b>Plan</b>	<b>Deployment Surge</b> <b>Replenishment</b> <b>Sustainability</b>
<b>Track</b>	<b>Closure</b> <b>SORTS</b> <b>End-Items</b> <b>Sustainment Stocks</b>
<b>Predict</b>	<b>Closure</b> <b>Sustainability</b> <b>Movement Capability</b>

There is also a need to plan replenishment and therefore sustainability. Required replenishment derives from the forces involved and what they are doing. Food, water, and some amount of fuel replenishment are always required, but ordnance replenishment is not a major issue until your forces are engaging the enemy. Replenishment so that the forces have the necessary sustainability requires just as much planning as the deployment of forces.

The CLCC system should also have the ability to address the planning of in-theater distribution. JOPES is focused on rushing forces into a theater. Two of the tenets of Focused Logistics, Ref (22), are Joint Reception, Staging, Onward Movement and Integration (JRSOI) and Theater Distribution. Ref (22) states, “Planning and executing deployments is supported by JOPES, but this system has significant limitations that impact on JRSOI operations. JRSOI is designed to eliminate much of the confusion associated with people and equipment arriving in theater in disorganized pieces and break down the bottlenecks that have historically existed in large-scale joint operations.” Ref (22) goes on to say that, “Theater Distribution calls for a comprehensive in-theater distribution system for deployment, sustainment, and redeployment of units, personnel, materiel, and equipment that is seamlessly integrated with the strategic logistics system.”

As argued earlier, the CLCC system should offer the capability of tracking the status of closure, unit SORTS data, the status of major end-items of equipment, and sustainment stocks. Tacking of closure information provides closure status for units which have not yet closed. Comparing closure status with the deployment plan offers the capability of evaluating how the deployment is going. SORTS data provides information on the location and readiness of individual units. End-items are normally reported in terms of the number on hand and the number authorized, the number mission capable and fully mission capable, and, for equipment not in one of these categories, whether they are not mission capable awaiting maintenance or not mission

capable awaiting supply. The tracking of sustainment stocks should be in units of days of supply (DOS) rather than in tons, gallons, or units. In order to report in days of supply for commodities of interest within the ten supply classes, the raw data must be converted using population data and usage planning factors.

Finally, the CLCC system should be capable of prediction: prediction of closure when it has not yet happened, prediction of sustainability, and prediction of movement capability. More generally there should be the capability to evaluate alternative courses of action when they involve logistics issues. The ability to predict allows interaction between logistics and operational planning and execution. If the prediction capability is present, "what if" questions can be posed and answered. The ability to predict implies explicit consumption planning factors, models of consumption (ordnance, spare parts, fuel, rations, etc.), models of intertheater and intratheater transport capabilities, and a lot of in-transit visibility information. Predicting closure involves information on shipments already made, in-transit visibility, and TPFDD information on shipment planned dates. Prediction of sustainability requires data on stocks held, stocks flowing into the theater, and models of their usage. The ability to predict movement capability is important in general because it is not sufficient to have fuel and ordnance in theater if it cannot be transported to the forces that need it. There can also be the issue of moving the forces themselves as was seen in the Gulf War's Left Hook movement.

As described, the Combatant Logistics Command and Control system is fairly large. It is likely a federation of systems. It is important that any data need be entered only once (one-time data capture). It follows that there must be common data definitions employed across the Services and defense agencies.

#### **6.4 The Tactical Logistics Support System**

There is a logistics support system which allows the planning, tracking, and prediction of logistics sustainability. The focus is a Navy carrier battle group or battle force. The system is the Tactical Logistics Support System (TACLOGS), Ref (23), and it exists as a tactical application within the Navy's Joint Maritime Command Information System (JMCIS). JMCIS is the Navy's command and control system.

JMCIS has its origins in the Joint Operational Tactical System (JOTS) created by Vice Admiral Jerry O. Tuttle in the mid 1980s. The purpose of JOTS was to create a common tactical picture, comprehensive of friendly and hostile forces, and let all friendly forces play from the same sheet of music for the first time. JOTS took friendly ship position, course and speed data as broadcast by individual ships, merged this data with surveillance and intelligence data on hostile positions, and created a fused tactical picture which was then broadcast to all command centers and ships.

TACLOGS was developed because of the following circumstances. Commander, Second Fleet had signs posted in his afloat command center which stated that battle watch

officers were at all times to be able to answer four questions: Where is the enemy?, Who has him engaged?, How are we doing?, and What is our sustainability? The command and control system, JOTS, was providing most of the information about the first three questions but it did not consider logistics and thus was mute on the question of sustainability. What the Commander was getting in his morning logistics briefings was one or two day old data on events and commodity levels. Sustainability is about the future, not the past, and it can only be addressed through prediction. Thus, any system for addressing sustainability must be able to predict the use and replenishment of the commodities which limit sustainability.

In Section 4 of this report it was argued that the critical commodities for ground forces were fuel, water, and ordnance. For naval forces, critical commodities for ships in combat are fuel and ordnance. Ships make fresh water from sea water, so water does not limit the sustainability of naval forces. Thus, to a first order approximation, the sustainability of naval forces in combat can be predicted if the use and replenishment of fuels and ordnance can be modeled. This is what TACLOGS does.

The use and replenishment of fuels and ordnance by individual ships of the battle group or battle force are predicted based on either the passage of time or the occurrence of specific events. Fuels includes both ship propulsion fuel and aircraft fuel. Ship propulsion fuel use is predicted from a polynomial expression whose parameters depend on the ship class and speed. Aircraft fuel usage is predicted from postulated norms of flying activity as a function of the appropriate threat level and the fuel use associated with the occurrence of specific events (raids, strikes, or ASW prosecutions). The only ordnance for which there is daily usage is sonobuoys, and this daily usage depends on the undersea warfare threat level. All other ordnance usage is associated with the occurrence of specific events. No ordnance usage is predicted on a pounds per man per day basis.

All relevant data (fuel capacities, nominal ordnance loadouts, usage and replenishment planning factors, etc.) are contained within the TACLOGS software for all Navy ship classes, aircraft, and ordnance types, thus making setup relatively painless. Almost all data may be edited and all predictions may be updated based on daily operations summary reports from the individual ships so that any prediction errors are not perpetuated. The bottom line is the ability to produce reports indicating the fuel and ordnance states of individual ships and predictions of these states for each of the three days ahead thus addressing the sustainability question, at least in the short term. This is how the tracking and prediction processes are performed. At the conclusion of a major fleet exercise, the Commander Second Fleet stated that TACLOGS allowed him to "aggressively pursue tactical logistics" for the first time.

TACLOGS can also be used for planning and training. Its functionality includes the ability to steam the ships of a battle group in the computer, while in reality all the ships are in port. With ships underway and with threat levels set, fuels will be used and will have to be replenished. Similarly, execution of ordnance using events (raids, strikes, and ASW

prosecutions) in the computer generates the use of ordnance and the need to replenish ordnance. In the short term, battle group combatant ships can be replenished by the group's logistics station ship(s). Beyond the short term however the station ship will itself require replenishment and this must be explicitly planned. Thus TACLOGS can be used to plan for the required replenishment. Alternatively, in the training mode, TACLOGS can introduce the battle group staff to the sustainability problems they are likely to face so that solutions will be in hand when they do go to sea.

## 7. CONCLUSION

*"Logistics is second to nothing in importance in warfare."*

Vice Admiral Robert B. Carney, 1947

The Joint Forces Commander in the Gulf War set a requirement for 60 days of supply of all logistic material as a way of assuring that he had appropriate levels of sustainability for his forces. These stocks took a long time to accumulate, created a huge footprint, represented potential vulnerabilities, and much of them had to be back hauled when the war ended. There were also a number of other logistics problems revealed in the Gulf War. Rather than being forgotten since the War, logistics has been receiving considerable attention.

Focused Logistics is one of the four operational concepts of Joint Vision 2010. It has become the umbrella under which all the initiatives in logistics have been gathered. Many of the initiatives are fixes for Gulf War logistics problems (In-Transit Visibility, Joint Reception, Staging, Onward Movement and Integration, and Theater Distribution). Some of the initiatives are associated with shrinking Service logistics systems and operating them more economically (Velocity Management, Lean Logistics, and Precision Logistics). Finally, some of the initiatives are associated with information technology (information fusion and the Global Combat Support System). So long as the objective in GCSS is to track data, it will not fulfill the goals of what is here described as a combatant logistics command and control system. Finally, the *Focused Logistics Roadmap* describes an additional initiative called Joint Theater Logistics Command and Control. This is not a logistics command and control system, however. It is rather an organization to support the in-theater portion of a major regional contingency or small scale combat operation, according to Ref (22). Thus logistics command and control remains to be addressed.

This report has described the Joint Forces Commander's need for logistics information. This statement has several implications. The first is that commanders and not just logisticians need logistics information; *to exercise control at the strategic, operational and tactical levels of war, commanders must also exercise control over logistics.* Operational logistics is operational and tactical. Running out of fuel or ordnance is an absolute combat stopper. The second implication is that information is needed, not just data. The paradigm is that data processed

through logistics models produces information useful for creating a logistics picture of the battlefield, for predicting sustainability, and for evaluating alternative courses of action.

To be able to plan sustainment and predict sustainability from data on stock levels, there must be models of the use and replenishment of logistics commodities such as fuel, water, ordnance, etc. Such models use logistics planning factors, but they are more than planning factors. The models must reflect operations, ours and those of the enemy, as they affect the use of fuel and ordnance. Of course "garbage in, garbage out" still applies, so the logistics planning factors need to be current and valid. This is not currently the case.

The Joint Forces Commander must plan the deployment and employment of his forces. He needs to track unit closure and equipment status. He also needs to plan for the sustainability of his forces. Current doctrine states that the Services have the responsibility of sustaining their forces, but the JFC has an interest here too. He needs a logistics command and control system which will allow him to plan the sustainability of his forces, to track the status of their stocks of supplies, and make running predictions of sustainability. Without this capability, he is doomed to having to use brute force and require 60 days of supply to assure that sustainability will be adequate.

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## APPENDIX

### 22nd SUPCOM LOGSITREPS

The 22nd Support Command under LTG William G. Pagonis was the ARCENT echelon above corps logistics organization during Desert Shield, Desert Storm and Desert Farewell. The daily Logistics Situation Reports (LOGSITREPs) of the 22nd SUPCOM were directed to ARCENT, CINCCENT, the Pentagon, and Army logistics agencies. Seven of these LOGSITREPs were examined to see the types of logistics information being prepared for ARCENT and CINCCENT.

#### **LOGSITREP #27 of 1 September 1990**

The 1 September LOGSITREP contained departure data for incoming Army units, but no indication of their arrival time or where they would arrive (POD). It gave Commodity Class (Subsistence, Ammo, POL, etc) status for stocks belonging to the Army and indicated critical items. A critical item was any item whose on-hand days of supply was three days or less. It provided information on APOD flight arrivals and SPOD ship arrivals that day and cumulatively to date along with the numbers of passengers, trucks and helos. It indicated four ships in port being offloaded and one waiting at anchor, but did not indicate their cargo or the unit(s) for whom the cargo was intended. It also gave the status of host nation real estate leases and construction contracts. Clearly, at this early stage of the build up, in-transit visibility of units, equipment and material being shipped into the theater was not available.

#### **LOGSITREP #57 of 1 October 1990**

This report begins with Commodity Class status information, beginning with Class I subsistence items. The numbers of MREs, T-RATS, and A-RATS are provided along with the information that a ship arrival had just increased the number of MREs available significantly. It noted that they are seeking permission from Saudi officials to drill wells in the area then occupied by the 24th Infantry Division. A word of caution is given that "theater reserves for bulk water can not be implaced until Water Supply Companies arrive;" recall that it was tooth before tail in the deployment priorities. All other commodity classes plus Transportation/Mobility, Supply and Service, and HNS are shown as having no problems. POL on-hand and storage capacities are shown for ARCENT and MARCENT but not for CENTAF. No days of supply are shown. ARCENT and MARCENT POL forecasts for the next five days are shown; none of the numbers change from day to day. Class V, ordnance, status is shown in numbers of rounds for artillery and tank ammunition, rockets, mortars, and mines.

Class VII, major end-items, is reported for Army aircraft, tactical vehicles, rocket launchers and Patriot. Status is given in terms of the number authorized, on-hand, mission capable, and operational ready rate. Some of the ready rates are low and it is the availability of

spare parts rather than maintenance capability that is creating the situation. APOD information includes flights arriving this day and cumulatively to date, passengers received today and to date, and major end-items and pallets received today and to date. SPOD information about ships in port and the unit for which their cargo is intended. The report ends with transportation notes. The first is that FORSCOM has asked if they desire that four heavy transportation companies be added to the TPFDD and flow. SUPCOM responds that they need more information and points out that they have contracted for HNS heavy equipment transporters (HETs) to meet immediate needs and more. The last note is that 94 pallets of ordnance were inadvertently backloaded on the delivering ship and returned to CONUS.

#### **LOGSITREP #88 of 1 November 1990**

This report is very similar to the one of 1 October in format and information. It notes a shortfall of 2.2 million unitized B/T meals and that the shortage is impacting unfavorably on the theater food plan. It also notes that U.S. hams for Thanksgiving and Christmas would be accepted. In anticipation of decreasing temperatures, field jackets and liners, parka liners, and gloves are requested in quantity and Desert Express shipment of these items is requested. Current population data is given for ARCENT and MARCENT, but not for CENTAF. The water status section begins by noting that the units receiving the new 600 gallons per hour ROWPUs will require new equipment training team (NETT) services for both operation and maintenance and thus it was requested that the NETT be deployed soonest and not later than 14 November. CENTAF does not report its water storage capacity or on-hand quantities. It looks like the 82nd Airborne Division on-hand water supply is only a few hours worth, but the LOGSITREP notes that not all units are reporting.

POL reporting is as in the 1 October report with the exception that Navy F-76 (distillate marine fuel for ships) and JP-5 jet fuel quantities are shown in the report under theater stocks (the only time F-76 is ever reported). Recognition that POL and ordnance are going to be the logistics drivers is reflected in the reporting of detailed information about the Petroleum Companies in country and the rounds of artillery shells shipped from the SPOD to theater and corps supply areas. In this report aircraft availability (Army aircraft) is shown as FMC (fully mission capable) and PMC (partially mission capable) and the OR (operationally ready rate which is (FMC + PMC) divided by on hand). Other combat essential items (tactical vehicles, artillery, etc) is shown only as MC (mission capable) and the corresponding OR. In other LOGSITREPs, the OR is shown as ER (equipment ready rate). For end-items not mission capable, the majority are awaiting repair parts but the number awaiting maintenance action is increasing. APOD and SPOD information is in the same format as earlier LOGSITREPs and again there is visibility of only ships actually in the ports in theater.

#### **LOGSITREP # 118 of 1 December 1990**

This report begins with focus on their ability to maintain theater POL stocks and notes dependence on receiving SWA couplers from Europe. They have no estimated delivery date or

identification of the carrier of this equipment. This report does however show information on vessels en route from Europe, their manifests, the unit for which the cargo is intended and the ship's estimated day of departure. This is the first indication of visibility of ocean shipping prior to its arrival in port. Under significant issues are five items: (1) HMMWV tires are realizing an average life of only 3000 miles, (2) lunch bucket meals are not an acceptable replacement for "top shelf" entrees, (3) the order for Christmas pies, fruit and vegetables and Wolfmobile items is verified, (4) verification that B rations for the Marines were ordered by DCSLOG and will arrive 15 January, and (5) mail parcels are being received in damaged condition.

In the paragraph titled OR Rates, aircraft readiness is given in terms of FMC, PMC and ER (equipment ready rate). Aircraft not-ready rates now reflect maintenance availability rather than the availability of repair parts. Other end-item readiness is reported in terms of MC and ER. APOD and SPOD information was in the same format as earlier LOGSITREPs. The subsistence report lists rations for Army, Air Force, and Marine Corps separately, provides "strength" numbers, and converts rations on-hand into days of supply; now 30 days or greater. The water report gives population data except for CENTAF and the population numbers are not the same as the "strength" numbers for the Marines. Water capacities and on-hand quantities are shown for ARCENT and MARCENT with CENTAF indicated as not reporting. Significant detail of ARCENT water purification and storage sites is given. POL data is given for each Service and theater totals; CENTAF reporting. Again a five day forecast is given but none of the numbers change. ARCENT Petroleum units in country are listed and the list is rather longer than a month earlier. The Ammo report indicates missiles delivered from the SPOD to theater supply area #2, the bombs moved from SPOD to Al Kharg Air Force base, and the amount in rounds of 25mm and 120mm ordnance in theater and, separately, due in.

#### **LOGSITREP #149 of 1 January 1991**

The 1 January LOGSITREP began with the status of the VII Corps movement to their field positions and of their movement assets (HETs, lowboys, and flatbeds). The report contained the status of major end-items (aircraft, vehicles, Hawk & Patriot) in terms of the number authorized, number on-hand, and number fully and partially mission capable. These were Army systems and the LOGSITREP did not contain information about Air Force, Marine Corps, Navy or coalition systems. The status of systems information gave totals only and did not attempt to associate the systems data with the units to which the systems belonged. As in earlier reports, the number of airlift flights into theater APODs to date were reported along with the total number of passengers, wheeled vehicles, pallets, and trailers received to date. Without more detail, it is difficult to see how this type of information aided in creating a logistics picture. Port information included ships at berth in the theater SPODs, the unit for which their cargo was intended, and the status of the ship's offload and estimated time of departure. Clearly equipment arrival information had improved by this date. There was a list of critical Army spare parts to be expedited from CONUS sources via Desert Express airlift. Rations, MREs and T-RATs, supply status was reported for ARCENT, MARCENT, and CENTAF in days of supply. There was information on force strengths. The population information, together with the logistics planning factor (units per

man per day), was necessary to determine the days of supply on hand for any given commodity. While ARCENT's current population was reported, MARCENT and CENTAF populations are noted as "not reported". The difference between strength and population is unclear.

The status of the water situation was extensively reported, ARCENT information only. CENTAF and MARCENT were meant to be included in this report, but annotation indicates that no reports were received. Purification/storage sites were listed with their ROWPU equipment, their storage capacity, their gallons of water on-hand, and the unit(s) they were supporting. With population data and gallons per man per day planning factors, the days of supply represented by the quantity on-hand was computed. The information was footnoted to indicate that the on-hand quantities and days of supply figures did not include bottled water on-hand nor host nation provided water. MARCENT and CENTAF reported neither populations, water storage capacity, or quantities on-hand; thus no days of supply computations were possible for these forces.

POL, diesel and jet fuel, would be crucial to the air war to start in 15 days and the ground war of the next month and were extensively reported in terms of storage capacity, on-hand quantities, and the days of supply the on-hand quantities represented - mostly 3 to 8 days. The logistics planning factors for fuel use per day (motor gas, diesel, and JA1/JP5 jet fuel) are not indicated. POL information was shown for ARCENT, MARCENT, and CENTAF, and by logistics base location. An additional feature of this report was the forecast of component theaterwide fuel stocks for the next five days; no changes in on hand quantities were forecast. Ammunition, also important, was not featured in this LOGSITREP. There was a single note saying that no ammo had been shipped on that day. While the ground war would not begin for almost two months, the start of the air war was just two weeks off and the availability of precision guided munitions for the Air Force, Navy and Marine Corps tactical air forces would logically be of importance to the Joint Forces Commander.

#### **LOGSITREP D+16 of 1 February 1991**

The 1 February LOGSITREP began with information on the VII Corps, vehicles received and moved forward, and soldiers in temporary billeting awaiting onward movement. The numbers and operational status of Army systems were again displayed, separate data for each of the two Army Corps. Mission capable rates were high and separate data indicated the reason (maintenance or supply) for the not-capable systems. Highlighted was the status of Echelon Above Corps (EAC) transportation assets (trucks, trailers, and buses) which were crucial to the movement of forces from POD to their field positions and, later, to their jumping off positions. APOD airflow data for the report date and cumulative to date in terms of passengers, vehicles, and pallets were displayed by Corps. Intratheater airlift scheduled in support of each Corps was shown. Cumulative sealift offload was tabulated in terms of short tons (of material), tracked vehicles, wheeled vehicles, aircraft, containers, and other in support of each Corps. Containers are now being reported separately in terms of the numbers at each logistics base, and those moved that day from Riyadh to a logistics base and their contents.

Ammunition is reported in terms of the number of trucks from the ports of Ad Dammam and Al Jubayl to each of six Theater or Corps support area destinations, together with comments indicating the number of trucks carrying ammo for the Air Force. There is no indication of the quantities or types of ammo being transported. Later in the report there is a section detailing ammunition supply point status in terms of short tons of ammunition on hand. Quoting ammunition stocks in terms of truck loads or short tons provides very little useful information. The Army also used precision guided munitions in the Gulf War and the stocks of such munitions would have been worth reporting in detail.

The report, like the earlier ones, extensively reported water, rations, and POL status, listed Army critical spare parts shortages, postal operations, and SPOD ship offloading activities. This report also noted significant POL ground transportation shortfalls; only 23% of nearly 1500 host nation trucks scheduled could be dispatched on this day.

#### **LOGSITREP D+41 of 26 February 1991**

The last LOGSITREP cited here was for 26 February 1991, two days after the start of the ground war. It is the most lengthy and detailed of the LOGSITREPs examined. Overall it reveals that personnel, ammunition, and other material are still being received in quantity and that ground transportation asset mission capable rates are falling. Trucks have mission capable rates of from 30 to 90% depending upon type and buses are only about 50% mission capable reflecting their heavy use; LTG Pagonis stated that they were driven 52 million miles by Service personnel and contract drivers, Ref (2). There is the usual APOD flight arrival data for the day and cumulative to date. Knowing that there had been 2017 C-5 arrivals, 2958 C-141 arrivals, and 2066 commercial aircraft arrivals to date is interesting but does not contribute directly to a logistics picture on the second day of the ground campaign. Similarly displaying those aircraft loads to have included 343,096 passengers, 77,299 pallets, and 13,117 vehicles does not provide the logistics status information needed. None of the "goods received" information is compared with the numbers required or planned so other than being impressively large numbers, one fails to know if the situation is satisfactory or not. Ground movement as truck loads or as numbers of pallets by Commodity Class for the day are provided. Most of the movement is of Class V material (ammunition). As was the case with APODs, SPOD ships discharged to date information is provided in terms of short tons of material, tracked and wheeled vehicles, aircraft, containers and other. Again there is no reference to required or planned numbers, so performance is impossible to judge. Ammunition movement data is again provided in terms of truck loads with no other information about the type or quantity of ammunition involved. Vessels at anchor awaiting offload are listed. Most have ammunition cargo and their manifest is available in most cases.

This LOGSITREP has a number of different and useful information displays. Critical munitions (120 and 155mm rounds, TOW, HELLFIRE and PATRIOT missiles, etc) status is given in terms of quantity available, quantity required, and percent of requirement on hand. This data is theater-wide Army munitions and is not given in Corps or division detail. No similar

munitions data is given for the other Services. Most of the Army critical munitions are in the 50-60% range of on hand vs requirement; hence the ship loads of ammunition still arriving at theater SPODs. The report also indicates that the type of ammunition in each ship was known and was used as the basis for assigning offloading priorities. Overall supply status in terms of major categories (water, rations, fuel, ammo, chemical decontamination equipment, and theater reserves) is displayed in "traffic light" format: green, amber, red; all are green or amber. Similarly, combat systems (tanks, APCs, artillery, missile systems, and helos) readiness is displayed both in terms of operationally ready rates and the green/amber paradigm for each Corps and the EAC (Echelon Above Corps).

As the balance of this LOGSITREP contained the usual material, only the more unusual information will be cited. It was reported that Desert Express material is being airlifted to the wrong APOD. This seems unusual in that, at this late state in the operations, such problems should not still be arising. In August when where units would bed down was not known, a lot of material was shipped with no address other than 'Desert Shield', but by February the location of all units should have been known to the shippers. There was a request for priority air shipment of flak vests to outfit coalition force soldiers attached to American units. This is the only mention of coalition forces in any of the LOGSITREPs available. VII Corps logistics issue #1 for this day was for assistance in obtaining a supply of Purple Heart medals. Their #2 issue was an insufficient number of 30mm gun systems for the AH-64 attack helo! Redeployment planning was already underway and so noted by 22nd SUPCOM. Fuels got more detailed reporting than ever before with usable storage, quantity on-hand, and days of supply quoted for every storage location in the theater. For jet fuel, the on-hand quantity was 93 million gallons and the daily requirement was estimated to be some 21 million gallons, so the overall days of supply was about 4.3 days.

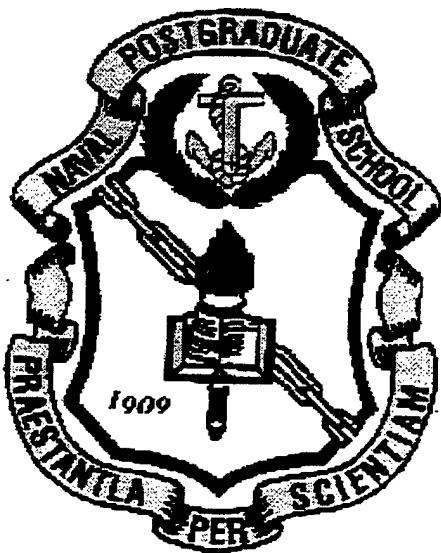
A final comment on the LOGSITREPs is that in most of them there are, sometimes extensive, notes explaining why the numbers do not add up or are inconsistent with other data in this or a prior report. Credibility is a good thing, but balance sheet accuracy is usually not required. The commander needs information which is timely and approximately accurate. It is important to realize that accounting system accuracy is not desired nor required in operational logistics.

1.	Defense Technical Information Center 8725 John J. Kingman Road, STE 0944 Ft. Belvoir, VA 22060-6218	2
2.	Defense Logistics Studies Information Exchange U.S. Army Logistics Management Center Fort Lee, VA 23801	2
3.	Library, Code 013 Naval Postgraduate School Monterey, CA 93943	2
4.	Dean of Research, Code 09 Naval Postgraduate School Monterey, CA 93943	1
5.	Department of Operations Research Naval Postgraduate School Monterey, CA 93943	1
6.	Admiral Archie R. Clemins Commander in Chief, U.S. Pacific Fleet 250 Makalapa Drive Pearl Harbor, HI 96860-7000	1
7.	VADM William Hancock Deputy Chief of Naval Operations (Logistics) 2000 Navy Pentagon Washington, DC 20350-2000	1
8.	VADM Alexander Krekich Commander, Naval Surface Force, U.S. Pacific Fleet 2841 Rendova Road San Diego, CA 92155-5490	1
9.	RADM John Gauss Space, Information Warfare, Command and Control, N6 2000 Navy Pentagon Washington, DC 20350-2000	2

10.	RADM Stephen R. Loeffler Commander, Logistics Group Western Pacific Box 3001 FPO AP 96534-3001	1
11.	James L. Johnson Deputy Director, Theater Assessments and Planning Program Analysis and Evaluation Office of the Secretary of Defense 1800 Defense Pentagon Washington, DC 20301-1800	1
12.	Deputy Chief of Naval Operations (Logistics) ATTN: Mr. John Kaskin, N42 2000 Navy Pentagon Washington, DC 20350-2000	1
13.	Deputy Chief of Naval Operations (Logistics) ATTN: Mr. Ken Tomcich, N423D 2000 Navy Pentagon Washington, DC 20350-2000	1
14.	Dr. Frank Perry Technical Director, Joint Interoperability and Engineering Defense Information Systems Agency 701 South Courthouse Road Arlington, VA 22204-2119	1
15.	Colonel Philip Yff, USMC The Joint Staff/ J4 Logistics Information Systems Division 4000 Pentagon Washington, DC 20318-4000	1
16.	Office of the Chief of Naval Operations ATTN: Dr. Susan Marquis, N81D 2000 Navy Pentagon Washington, DC 20350-2000	1
17.	Center for Naval Analyses ATTN: Sam Kleinman 4401 Ford Avenue Alexandria, VA 22302-0268	1

18.	Naval Ship Weapon Systems Engineering Station ATTN: Marvin Miller, Code 4M00 Port Hueneme, CA 93043-5007	1
19.	Samuel Leeds Naval Doctrine Command 1540 Gilbert Street Norfolk, VA 23511-2785	1
20.	Captain Christopher Goodhart Installations and Logistics, Code LX Headquarters, U.S. Marine Corps Washington, DC 20380-0001	1
21.	Professor David Schrady Code OR/So Naval Postgraduate School Monterey, CA 93943	100

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